ABSTRACT OF THE DISCLOSURE

HIGH STRENGTH ALLOYS AND METHODS FOR MAKING SAME

A family of extremely fine-grained alloys are used to make coatings or free-standing bodies having desirable properties for use as a heat-resistant and wear-resistant material. In an illustrative embodiment, the alloys are comprised of a multiplicity of alternate, microcrystalline or nanocrystalline films of tungsten metal and tungsten compound. The tungsten compound film may be comprised of a tungsten carbide or a tungsten boride. The tungsten films are the primary films. Their desirable characteristics, in addition to their very fine crystalline habit, *per se*, are the high strength, high hardness, high resilience, and high fracture energy which these fine crystallites foster. They may be manufactured by a chemical vapor deposition process in which reactive gas flows are rapidly switched to produce alternate films with abrupt hetero-junctions and thereby to produce the useful micro-crystalline habit. The unique synthesis method allows effective control of critical flaw size. The structure is such that the primary films may be made sufficiently thick so as to assure some desirable ductile behavior, but sufficiently thin so as to have high yield strength by dint of their microcrystalline size, and as to limit the size of any flaws. The secondary films are made of enough thickness to prevent the epitaxial growth from one primary film to the next-deposited primary film and thin enough so that they can not contain a flaw of critical size. In addition, the exterior surface of any body made by this method may have a sufficiently smooth surface that the strength of the body is determined by the bulk properties of the material and not by surface flaws.